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INDIVIDUALIZING UNIVERSITY INSTRUCTION, EXPLORING COMPUTER POTENTIAL TO AID COLLEGE TEACHERS BY DIRECTING THE LEARNING PROCESS. INTER-UNIVERSITY PROJECT ONE, PUBLICATIONS SERIES.

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THIS DOCUMENT CONCLUDES THAT INSTRUCTION BY COMPUTER-BASED RESOURCE UNITS CAN FACILITATE LEARNING AND PROVIDE THE INSTRUCTOR WITH VALUABLE ASSISTANCE. BY PRE-PLANNING THE TEACHING-LEARNING SITUATION, RESOURCE UNITS CAN FREE THE INSTRUCTOR FOR DECISION-MAKING TASKS. RESOURCE UNITS CAN ALSO PROVIDE APPROFRIATE LEARNING GOALS AND STUDY GUIDES TO EACH STUDENT. SINGLE COPIES OF THIS DOCUMENT ARE AVAILABLE FROM THE STATE UNIVERSITY OF NEW YORK AT BUFFALO, SCHOOL OF EDUCATION, 220A FOSTER HALL, 3435 MAIN STREET, BUFFALO, NEW YORK 14214. (MS)

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# INDIVIDUALIZING UNIVERSITY INSTRUCTION

Exploring Computer Potential to Aid
College Teachers by Directing the Learning Process

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# Introduction

Good teaching is the basic ingredient of any college or university endeavor. Though many other factors may influence the nature and scope of an institution's contribution to society, none is more central nor more crucial than the quality of instruction that characterizes its operation. Any processes or procedures which hold promise of improving the quality of leadership in teaching and learning situations should be in constant demand, for it is upon these that professional efforts must depend for solutions in the periods of stress and strain presently confronting colleges and universities.

That electronic devices and processes can be applied to educational endeavor has been envisioned by many as an approach to solving problems of instruction. However, in many instances suggestions for the use of such potential has been based upon a concept of the direct applicability of these processes to the teaching-learning process. So-called "teaching machines" of all sorts have been produced, the purposes of which have been to serve as the "mediator" between a body of knowledge and a learner and in this way conduct the learner through a prescribed series of manipulations. To many educators, the process of education is a great deal more than the transmission of ideas and bodies of information and the consequent accumulation of these on the part of a student. The use of the tremendous potential of electronic processes and procedures has appeared to be quite superficial and artificial when applied through such patterns of operation as has been characteristic of the "machine" approach.

The use of a computer-based instructional unit approach is a process by which the long-standing idea of teaching through well-organized pre-planned units of instruction can be served by the extremely efficient support of electronic equipment. The process consists of preparing exhaustive resource units on topics elemental in a subject area (a course sequence, a functional area of instruction or other emphasis around which a teaching segment is ordinarily constructed), coding the elements in the resource unit so that an instructor's selection of objectives will procure related instructional suggestions, programming this material and placing it in a computer retrieval system thus making it available for instructional support.

An instructor, in an area in which computer-based materials are available, has at his command the products of wide research and pre-planning which can be provided in usable form in a matter of minutes, upon the selection of the ends or goals (objectives) which he decides are those toward which he and his class should strive. Then, in terms of each learning outcome selected, he can be supplied with a subject matter outline of topics related to these objectives, suggested class activities which hold potential for achieving learning outcome, reference materials and instructional resources that are available, and suggested evaluative devices which hold promise for assessing progress toward the desired learning goals.

In addition, the computer-based resource unit process can supply individual study guides for each member of a class. Where an instructor is interested in promoting independent study procedures, it is possible for him and his students to select appropriate learning goals (objectives) and to be supplied by the computer with an independent study guide for each student. Here again, the guide would contain a subject-matter outline, reference materials and instructional aids, individual experiences of promise, and self-evaluational processes which can indicate progress being made toward achievement of objectives. The computer-based resource unit is thus a reservoir of instructional support, providing for teachers assistance in the instructional process. It is not a substitute for instructional effort but rather a means of support which will multiply, by unusual magnitude, the ability of an instructor to devise appropriate means for directing the learning processes of individuals and the group.

# Individulizing University Instruction

The basic ingredient of college or university endeavor is good teaching and the crucial element in good teaching is effective planning. Helping individuals learn requires countless hours of thought in order to organize materials and processes. An instructor must decide what should be accomplished, how procedures can be designed which hold promise for achieving such ends, what subject-matter elements must be explored in directing efforts toward such ends, what resources are available to support the activities desired, and, of major importance, what sorts of evaluative processes could be used to determine the progress being made.

That such effort is time-consuming and practically impossible under circumstances common in institutions today is quite well accepted. Though most instructors would accept the validity of the contention that good teaching depends upon the effectiveness and comprehensiveness with which such planning endeavors have been carried out, they are overwhelmed by the demands of the task and resort to superficial approaches to the detriment of learning possibilities. It is quite common for instructors to resort to the use of departmental "syllabi" which provide only a bare skeleton of material and this usually in the form of subject matter elements and selected references. From such superficial supportive material the majority of teachers must resort to sterile and mundane instructional practices none of which has been rooted in the basic learning goals for the area of work and, most unfortunately, not in any way related to the particular learning characteristics and learning inclinations of the students involved. If an instructor has the fortitude and professional interest to go beyond a cursory approach demanded in such a schema, he must expect to devote literally hundreds of hours to the pre-planning process alone. The pressure of student enrollments and other forces playing upon instructor time makes this an impossibility. It is to this basic and extremely crucial problem that the computer-based resource unit process is directed, a process which indicates that almost fantastic possibilities are now made possible through the wedding of electronic processes to the well-proven pattern of instruction encompassed in the resource unit approach.

## The Resource Unit

For many decades elementary and secondary teachers and college instructors have made use of the unit plan of teaching. This is a procedure which involves taking a "teachable element" of a course or subject and organizing around it a series of classroom and other instructional activities in which students can be helped to learn that which is considered important for them to achieve. Essentially, planning a teaching unit involves the selection of appropriate learning goals (objectives), deciding on the necessary content to be included, evolving patterns of learning experiences, surveying and making available the relevant instructional materials and aids, and finally locating or designing appropriate evaluative procedures. Thus, to teach effectively any element in any subject, a heavy investment of time and effort must go into preplanning of the sort which will make available all of the above resources to the teacher at the proper time and in the appropriate sequence.

A resource unit is an expanded and all-inclusive "resource file" for teaching the several elements that encompass a segment of work in an area. Typically, resource units have been developed around a "course" or "subject" emphasis in school or college work and these form the basic instructional resources for the support of instruction.

A resource unit consists of a similar set of elements as does the teaching unit, except that each set is expanded as far as possible. Lists of possible area learning goals (objectives) are compiled, encompassing every possible end toward which instruction could be directed. Subject-matter topics relevant to the ends desired are determined. Again, topics are included in as encompassing a fashion as possible. Suggested teaching-learning experiences, (classroom, laboratory, field-work, etc.) are noted, these in terms of their potential for exploiting the subject-matter concepts in relation to the goals desired. Attempts are made to develop exhaustive lists of available reference-materials and instructional aids. Finally, it is necessary to obtain or design appropriate evaluative devices to estimate progress in terms of the goals desired.

It is estimated that in order to develop a resource unit appreciable for an area of instruction, some 1000 hours of teacher commitment would be necessary for the pre-planning alone. This a magnitude of involvement not practical and in fact not possible in most instructional situations. Thus, the value of a resource unit to instructional improvement is quite questionable.

But since it is apparent that pre-planning is essential to good instruction and the resource

unit approach is an excellent means of supplying the ingredients for properly planned instructional efforts, is there a means for reducing the time and involvement of an individual instructor and still retain the advantage of the procedure? This is where an electronic computer can serve instructors with a competence unknown in human form. Through the design developed by Robert S. Harnack and applied successfully in schools throughout the country, it is possible to develop resource units in any area, code them properly, put them into computer retrieval systems and have them available to instructors in a fantastically short time. Resource units could be prepared in every teaching area--and this process would be required only once--and course-guides could be made available by print-outs to fit any situation, at the request of the instructor. This procedure will be described in detail in a following section, but first some comments about another function of instruction which the computer-based resource unit emphasizes.

## The Instructor as Decision Maker

One of the functions basic to any effective teaching-learning effort is the making of decisions about the variety of matters involved. In this sense the most important task of a teacher is that of making appropriate decisions and carrying out the functions that these project.

In an ordinary instructional situation, the teacher must decide upon what learning goals or ends (objectives) are to be served. In light of these, he must then decide what subject-matter elements are conducive to achieving such ends. There must also be sources to which learners can turn to obtain materials and aids to instruction. Finally, the instructor must determine how to assess the progress being made toward the objectives he has selected. Thus, the instructor must be able to make competent and appropriate decisions about a variety of matters relative to his instructional objectives.

In addition, there is a whole range of decisions which must be made in relation to the individual difference variables represented in class groups. Instructors are well aware that many factors effect the way in which instruction can be organized for different individuals. Class level, rendering ability, socio-economic background, motivation, interest and a variety of other factors effect the manner in which an individual student will react to an institutional arrangement.

The sincere teacher is therefore bewildered by this further demand upon his time and competence. Not only must he spend countless hours and abundant energy in the never-ending efforts to plan properly, but he must be constantly aware of the importance of the decisions he makes throughout the complete planning and instructional process. And no matter how inspired and able he may be, it is virtually impossible through human processes, to relate every element of planning and instruction to the multifold variables representative of the individual encompassed in a classroom group.

Here again the computer-based resource unit approach can be of unusual service. By coding every element of the material to individual difference variables, it is possible to have the electronic facility make decisions which are within its compass. This kind of operation can be performed with great facility by the computer.

In order to set a design for separating those functions in which instructors must perform their decision-making responsibility from those functions of retrieval which could be performed by electronic equipment, the following classifications were determined:

The teacher's functions were four in number.

1) To identify the subject of the teaching unit. To identify the basic unifying theme which would serve as the center of interest in the classroom during a specific period of time.

2) To define the students abilities, needs, characteristics, and interests, as these items relate to the selections to be made within the total unit.

3) To suggest possible learning outcomes in the form of behavioral skills, understandings, information, and peripheral objectives which may reasonably be expected to result from the teaching-learning situations developed through-out the unit.

4) To make, if deemed necessary, certain professional decisions related to those tasks or areas which the teacher deems important for the objectives and the students in the classroom.

On the other hand, the electronic computer satisfied the following functions:

1) To provide the teacher with a subject matter outline or problem census related to the learning outcomes identified by the teacher.

2) To suggest a significant (related to the learning outcomes and characteristics of the pupils) number of large group introductory and developmental activities.

3) To suggest a significant number of introductory and developmental small group activities.

4) To suggest a significant number of individual

learning activities which might prove to be helpful.

5) To suggest suitable instructional materials, including reference materials, for individual students.

6) To suggest appropriate equipment, audio-visual materials, and the like, for large group and small group instruction.

7) To suggest suitable references and other materials for the use of the teacher.

8) To suggest how achievement of these proposed outcomes may be evaluated.

9) To suggest "leads" to other related units (continuous activities) which might grow out of the proposed unit.

The electronic equipment can be used to overcome the drudgery inherent in certain functions an instructor performs as he organizes a teaching-learning situation. Since this is true, then one of the most difficult tasks which a teacher faces--finding the time for pre-planning the actual teaching-learning situations in the classroom--can be alleviated. In other words, the basic purpose for the use of electronic data processing equipment is to help teachers overcome this lack of time for pre-planning and for engaging in the process which will lead to the most effective decision-making possible in the areas where this is the primary function of the instructor.

## Individualizing Instruction

A brief note may suffice at this point to indicate the tremendous potential of the computer-based resource unit pattern of teaching for the individualization of instruction. In later sections this topic will be discussed in some detail particularly in reference to the adaptability of the process in college and university classes.

Since the computer retrieval system can store an almost unlimited number of items and can produce these in combinations of an equal number of variables, it is possible to sort through vast quantities of information and produce elements that are related to particular factors. Thus it is possible through proper coding, to obtain materials for instructional purposes that are related to selected factors. In terms of individualization of instruction, this process can be applied to obtain suggested instructional guides for use in large group activities, in small group arrangements, and for independent study efforts as well. In fact, where an instructor is interested in encouraging independent study activity to a significant degree, it is possible for him to supply an individual course guide for each student in his group. Again, this study guide would suggest subject-matter items, learning experiences, instructional resources and learning aids, and potential self-evaluative devices which might be used-- all coupled to the learning goals (objectives) that were chosen as the ends toward which the instruction was to be directed.

The electronic process requires only that materials in the retrieval system be coded in terms of significant individual difference variables (in addition to the coding in terms of objectives). When particular individual difference variables are fed into the machine along with the selections of learning objectives, there is produced a study guide which is "tailor-made" to the characteristics of the individual involved. This is a procedure which, though obviously necessary to direct independent study under any circumstances, would be humanly impossible were an instructor expected to provide it through ordinary means.

# Potential of Computer-Based Units in Higher Education

The basic design for producing computer-based resource units of instruction was developed initially by Harnack[1] for application to elementary and secondary school programs. The basic theory undergirding these efforts was that of developing the means of harnassing the tremendous potential of the electronic retrieval system to assist teachers in their efforts to make instruction meaningful and effective to students. The process which has evolved is one that has no charactertistics which limit it to any particular level of instruction. A supporting theory of all-encompassing nature and an operational design of complete adaptability makes this a scheme of importance to college and university instruction of no less significance than it is to the other level of educational endeavor. In fact, the lack of significant effort in higher education to adopt concepts of pre-planning and of unit teaching may indicate a need that is much greater on that level for improving instruction in a manner consistent with good educational theory.

Through the initiative of the Center for Curriculum Planning, School of Education, State University of New York at Buffalo, several representative resource units have been constructed in elementary and secondary instructional areas. These have been coded and put into the computer retrieval system where they have been tapped for use in a variety of teaching circumstances. Difficulties in programming, in coding, in production and in other aspects of the process have been analyzed and remedied. Under present circumstances, the background of experience in the "machine" phase is great enough to afford confidence that the process is not only workable but extremely efficient and effective.

The use of computer-based resource units in elementary and secondary situations has been studied through several intensive investigations.[2] These have supported, in an unqualified way, the contention that instruction can be enhanced by the use of computer-based resource units and that learning is facilitated in a very great measure when teachers are assisted through this process. In addition, it must be kept in mind, the electronic process support affords the teacher a resource of unparalled magnitude for enriching the work through processes not possible to the teacher alone. That is, the intracacies of coding and the almost instantaneous retrieval possibilities of related elements could never be achieved without electronic means.

## Resource Units Prepared in Teacher Education

Using the basic scheme that had been instituted so successfully for elementary and secondary development, resource units have been developed in Teacher Education instructional areas at the State University of New York at Buffalo. In a previous effort to design a Teacher Education program upon instructional elements of functional orientation sponsored through a Ford Foundation supported project, a teacher competency framework was developed.[3] This was an attempt to develop a program of teacher preparation based upon the concept that it is the competencies required of the teacher that should be used to determine the nature, scope and content of the program of instruction. Though this is not an uncommon concept, it is seldomly applied to the design of patterns of preparation. As a guiding principle, it would suggest that analyses of what a teacher must be able to do are the basis upon which a determination can be made of what a teacher must know. From this, relevant knowledge areas can be explored for contributions that can be provided and, along with other possible supporting activities these can be woven into a comprehensive series of program experiences.

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[1] Harnack, Robert S., The Use of Electronic Computers to Improve Individualization of Instruction Through Unit Teaching, U.S. Office of Education, Cooperative Research Project D-112, State University of New York at Buffalo, Buffalo, New York, 1963.

[2] Hicken, James E., "An Experimental Analysis of the Effects on Pupil Achievement of an Electronic Information Retrieval System in Unit Teaching." Goldberg, Minerva J., "Using a Resource Guide to Pre-Plan a Unit of Instruction." Eisele, James E., "Using Resource Guides to Teach the Skills of Critical Thinking." Holden, George S., "Changes in Instructional Behavior of Non-Unit Teaching Teachers When Resource Guides are Used." All Unpublished Doctoral Dissertations, State University of New York at Buffalo, Buffalo, New York.

[3] Fall, Charles R., Behaviors, Knowledges and Basic Concepts as Related to Teaching, Inter-University Project One, State University of New York at Buffalo, Buffalo, New York, January, 1963.

This concept can be outlined as follows:

I. Teacher Competency

What a teacher needs to be able to do--the decisions a teacher must make, determines:

II. Knowledge

What a teacher must know in order to be able to do, which in turn suggests:

III. Basic Concepts

The basic concepts from areas of knowledge which could be useful, and the:

IV. Teacher Preparation Experiences

Activities which should be designed to promote effective learning in the areas desired.

Upon this thesis the area of teacher functioning was explored for those elements of competency which defined what a teacher ought to be able to do. The following areas of functioning were accepted as being fundamental to the role of the teacher, and in each the particular responsibilities were outlined and the concomitant knowledge elements and basic concepts were related to those functions:

I. A Teacher Works With Individuals

II. A Teacher Works With Small Groups

III. A Teacher Works With Large Groups

IV. A Teacher Assumes Instructional Leadership

V. A Teacher Works With Other Teachers

VI. A Teacher Works With A Total School Staff

VII. A Teacher Works With Parents and Laymen

VIII. A Teacher Works With Professional Organizations

IX. A Teacher Continues Professional Growth

Again, in each of these functional areas there was developed the three facets: What the teacher must be able to do; what the teacher must know in order to be able to do these things; and what basic concepts were necessary to support such knowledge.

This program design was used as a basis upon which to develop resource unit material in the area of teacher education. Rather than design resource units around traditional teacher education course areas it was felt that the functional areas provided a much more appropriate base for applying the innovative potential of electronic processing. It should be emphasized however, that any basic instructional pattern can be used as the foundation for resource unit development. In fact, the pattern is applicable to any area of instruction and to any program design in which instruction is being offered.

Following through on this basic design an attempt was made to initiate development of resource units in each of the instructional areas. Through the cooperation of the Teacher Education faculty several pre-service classes were included in the developmental project. Using the "study of the individual" as a basic theme, students assisted in the outlining of what a teacher needed to be able to do (learning goals-objectives); what knowledge was necessary in order to do this effectively (subject-matter content); reference materials and institutional aids; suggested activities through which learning might be facilitated; and possible evaluation processes. The materials gathered in this fashion formed the basis for the resource unit, Individualizing Instruction in Teacher Education.[4]

Similar work will provide resource unit materials for the remainder of the instructional areas providing for Teacher Education instructors a reservoir from which pre-planning effort for instructional programs can be done with somewhat less investment of time and effort than is ordinarily required. With such a compilation of materials an instructor should:

-- Compile a selected list of the desirable outcomes suitable to the situation and a list of the main items in the subject matter content outline to be emphasized in the study.

-- Determine the approximate amount of time (4 weeks, 6 weeks, etc.) which can be devoted to this unit of instruction.

-- Study the possible activities that might be used and select those which best meet the needs and interests of the student in the class.

-- Itemize the instructional materials needed for these activities and make the necessary

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[4] Fall, Charles, Harnack, Robert, and Hicken, James., Individualizing Instruction in Teacher Education, Part II--A Resource Unit, Inter-University Project One, State University of New York at Buffalo, Buffalo New York, May, 1966.

arrangements with persons and agencies involved.

-- Determine, as carefully as possible, that the activity and materials chosen will aid the pre-service teacher education students in obtaining the desirable outcomes of the unit in terms of fundamental skills, understandings, and attitudes.

-- Identify possible evaluation devices (observation by critic teachers, paper-pencil tests, group discussions, inventories, anecdotal records, conferences, etc.) which might be used to determine whether or not the objectives of the unit are being obtained. When the above pre-planning is completed, the instructor can use this pre-planning as a frame of reference to aid his own thinking as he plans with and guides students.

Though the printed resource unit is an extremely valuable reservoir for improving instruction primarily because it provides a basis for adequate and comprehensive pre-planning, it is still a somewhat crude device in terms of possible sophistication through electronic processing. Thus, the materials of resource units in teacher education are being refined and processed for use in the computer-based instructional process. A description of this process will be provided in a later section.

## Application to Other Instructional Areas

At the point of this writing no efforts are being made to incorporate the computer-based resource unit concept into the instructional design of other college and university areas. However, the processes involved and the procedures followed have demonstrated a prototype through which any instructional area could be developed and materials be made available through the resources of electronic processing. Course areas in the Humanities, Social Sciences, Basic Sciences, or any area of University endeavor could be organized for computer-based resource unit instructional assistance and any instructor--whether a novice or a long time expert--could have available, on almost instant notice, the cumulative endeavors of the entire field of knowledge. Further elaboration of such prospects will flow through the remainder of this presentation.

## The Potential for Individualizing Instruction

Computer-based resource unit instructional processes have almost fantastic possibilities for individualizing instruction in any area. Not only can course or class work be designed in terms of the individual characteristics reflected within a group, but actual independent study outlines can be produced for any number of individuals in any area of instruction. Since the implications of this development are so great and the need for efficient and effective individualization procedures so desperate, extended comment on the topic is warranted in order that the potential available in computer-based resource teaching can be seen in its proper context.

Throughout the history of educational endeavor attempts have been made consistently to orient activities to the needs of individual students. Schools and colleges have always been concerned with efforts to fashion experiences in meaningful ways for the recipients of instructional programs. In earlier historical eras the complexity and the enormity of the task had little of the magnitude apparent in institutions today, yet, there is little evidence of outstandingly successful efforts in the past upon which programs of modern scope can be built. Though it would be most difficult to accurately identify a specific time when independent study was introduced as an organized program element it would appear that it has had a long and creditable career. Certainly we can identify independent study in the earliest beginnings of our own country. Perhaps one of the most basic reasons for this can be attributed to the fact that this was the only form of advanced educational opportunity that was available to interested students in this country.

The earliest development of independent study, identified as such, seems to have had its roots in graduate schools of the eighteenth and nineteenth centuries. As a result of its apparent effectiveness many undergraduate programs initiated programs of independent study. It must be noted, however, that basically independent study as a technique to be utilized in the undergraduate programs was designed to function only for those of exceptional ability.

The concept of the dissertation, thesis and eventually the term paper all appear to be attempts at providing experiences in independent study. As a general rule these tend to take the form of culminating activity in which the student draws together all areas of his study, under the guidance of an advisor, into a unified report. It was hoped that these would not only contain factual information but rather would afford the student an opportunity to draw conclusions and relate findings of his study to other areas.

Another factor in the development of independent study activity was concern on the part of institutions that students could not select courses or investigate areas of study that were of interest to them. Independent study programs could be used to broaden the scope of established courses or to extend the vistas of study to include areas in which students were interested but for which no organized

course offerings were available. Further, it became obvious that the independent study approach permitted students to investigate several different areas simultaneously, thus in reality, eliminating many classroom courses heretofore considered essential.

Since the turn of the century there has been considerable discussion concerning the concept of individualized instruction and the need for it in our educational system. Independent study appears to be one of the primary vehicles for promoting individualization of instructional activity. By 1920 independent study was well established as a form of individualizing instruction. In the years since that time there have been greater utilization of the concept along with many revisions of its principles.

## Common Approaches to Individualized Instruction

The concept of Individualized Instruction has wide acceptance in educational institutions today and efforts to broaden the scope of application are constantly being made. Basically these efforts fall into three general categories as they are developed into organized programs. These are honors programs, tutorial programs and independent study programs.

## Honors Programs

Generally speaking, honors programs have been organized to provide broaden and extended opportunities for superior or gifted students. Though actual program arrangements differ among institutions, the basic concepts and organizational features are common. Selected students--those who meet the grade-point criteria for admission--are permitted to program a portion of their work through independent study arrangements. Fundamentally, the independent study aspect is structured as individual project work under the supervision of an instructor qualified in the area of emphasis.

Several major criticisms have been reported of these efforts.* That these efforts are apportionately confined to a small number of students and a particular segment of college population is self evident. It is also apparent that the independent study emphasis of honors programs is quite narrow in scope and restricted in quantity. Thus as a general approach to individualizing instruction, honors program attempts have not served a widespread purpose in educational institutions.

## Tutorial Programs

Many institutions have promoted programs of individualized study organized around a concept of tutorial activity. Though this is generally similar to an honors approach in that students are selected as being academically superior and are permitted to engage in independent study endeavors, it is more constricted in scope of investigation and directed in terms of faculty supervision. Primarily, it is a plan in which superior students are permitted to work directly under the supervision of a faculty specialist to undertake the study of a specified area of work. Here again the inherent constrictions on the number of students eligible to participate and the restrictions on breadth and scope of study endeavor, renders such programs somewhat ineffective as institutional efforts to stimulate independent study and creative approaches on the part of the student clientele.

## Independent Study

The term "independent study" is coming more and more into common usage to describe broad-scale attempts to provide for individualization of instructional efforts. Since honors and tutorial programs have typically involved organizational features with inherently constrictive and restrictive features, these have been supplanted in many institutions by the more extensive independent study endeavors.

Though the caption covers programs of extremely wide variation and numerous emphasis some elements of commonality are identifiable. Of greatest importance perhaps, is the effort to broaden the scope of programs to permit large segments of the student population to participate. This is in response to the apparent restrictive quality of honors and tutorial programs and the realization that superior academic status is not the prime predictor of possible success in independent study activity. Nor can the restrictions inherent in high grade-point qualifications provide evidence of competence to engage in independent study with effective application. Hence modern independent study emphases are encouraging the availability of this kind of activity to as broad a segment of the student population as is possible to accommodate.

A second feature of independent study is to extend opportunities through a wider scope of the university program. This is done both vertically and horizontally--that is, from freshman through advanced graduate study and throughout the areas of offerings within the total institutional program. Here again there is a reaction against the restrictive character of honors and tutorial programs. Typically these were programs encompassing only the upper levels--either graduate work or at the

*Summarized cogently in: Winslow R. Hatch and Ann Bennet, "Independent Study," New Dimensions in Higher Education, Bulletin No. 1, Washington, Office of Education, U.S. Dept. of Health, Educ. and Welfare, 1963, pp. 4-6.

most, the upper division of an undergraduate sequence. As a result students were deprived of early introduction to independent activity and were likely to be structured in their study patterns so as to accommodate very poorly to the expectations of independent effort. Since the introductory phases of college life involves a fairly definite break in the study life of students, it is felt that this is the most appropriate time to emphasize an independent and individualized approach. Becoming adjusted to a passive role through conventional methods in the freshman and sophomore years has a tendency to make later independent study work more difficult, distasteful, and meaningless.

A third characteristic of current independent study patterns, is the attempt to organize learning activity around needs, interests, and concerns. Former programs of the honors and tutorial type were structured with definite course-work character. In most instances the only "independent" quality was that the student was expected to follow the course program alone rather than in the company of others through lectures, discussions and/or laboratory activities. This present approach involves a more radical and comprehensive reorganization of the college program in an attempt to structure instructional activities around student interest areas and in terms of the contemporary needs of individuals preparing for effective participation in modern social contexts.

Further, independent study emphases of recent construction are structured around independent activity. Where in typical honors and tutorial programs, study was constricted to definite instructor-directed components and to specific outlines of areas to be covered, the truly independent study approach emphasizes a different orientation. In this sort of program students are given the opportunity to encounter problems about which they have concern and to investigate the available resources for obtaining the necessary knowledge and information that can be used in its solution. In addition they are expected to apply the information obtained and develop conclusions which are warranted by the material available. In such a process, the instructor provides guidance and acts as a resource person in efforts of the individual to really apply his own energies to the solutions of problems with which he has become involved.

## Need for Individualization of Instruction

It can hardly be denied that there is a need for continued attempts to build programs of education at all levels that are directed toward adequate individualization and focus upon the learner as a functioning organism. The concept of "individual differences" has long been a central reference point in educational parlance. However, few actual programs have reflected any great attention to individual orientation in instructional activity. The time at hand when implications can no longer be ignored and major efforts must be forthcoming to evolve appropriate individualized learning processes.

Several current conditions point up the urgency of the need. Perhaps the most obvious and crucial element is in the revolutionary nature of changing conditions and exploding conditions apparent in knowledge areas today. In cultures of a non-changing character, a program of structured and past-oriented education can very well suffice. In radically changing times the comfort of ageless principles and universal truths is an artificial one and these cannot be relied upon to provide effective guidance in the solution of contemporary problems. Thus it is imperative that instructional endeavors reflect an understanding of the revolutionary nature of present conditions and the inadequacy of procedures directed toward the transmission of knowledge.

A second factor that must be faced in program design is the extremely complex nature of social and cultural life today. In stable cultural contexts, educational institutions can be developed on concepts of transmitting a cultural heritage and inculcating the young with the proven principles of social intercourse around which the society operates. A program of education of this sort in complex and changing cultural climates can only contribute to confusion and personal alienation from the "mainstream" of endeavors.

Such comments lead to a third feature of modern circumstance that is calling for redesign in educational activity. This is the growing tendency toward personal alienation in various aspects of modern life. Anthropologists and sociologists are continually drawing attention to the major features of existing cultural settings which are alienating large segments of populations from the concourse of social endeavor. And, educational programs which are not rooted in the features of the times can only contribute to continued alienation where there is actually needed an intensive effort to assist students to make some meaning out of the lives of which they are a part and to see themselves as integrally functioning aspects of a total social organization.

Finally there is the factor involving concepts of the learning process which must be considered when assessing a need for individualization of instruction. Modern investigators are universally agreed that learning is an individual matter and it is only as instructional endeavors stimulate activity on the part of the learner himself that effective contributions can be made to his education. It can be agreed that this does not mean that each student must be taught directly by a single teacher, for this would lead to impossible conditions in educational institutions. It must mean however, that educational activity be organized in a fashion

that affords the individual an opportunity to see meaning in the process and serve to implement the organization of his interactions.

Thus, educational endeavors are imperative which can serve the needs of modern living. They must be directed at releasing the full human potential represented by every individual. To do this programs must be designed in response to an awareness of the everchanging features of life and of the knowledge and understanding which is necessary to make life meaningful. There must be an understanding of the ever-growing complexity of the cultures of which learners are a part and of the need for a kind of education that will assist the individual to understand his social environment and contribute effectively to its on-going processes. In addition, educational designers must be cognizant of the tendency toward alienation of the individual from the cultural order into which he has been thrust and must include in the pattern of education the kind of experiences which will provide the opportunity for the individual to become integrated into the total operational endeavors of his social order. And, finally, instructional design must reflect an awareness of the nature of learning and the extremely direct individual emphasis that must be characteristic of all learning activity.

Individualized instructional emphases are means through which many of these features can be incorporated into an instructional design. It is a process which envelopes the individual as the central feature in the learning process and is based upon a concept that learning is an individual matter. Further, through patterns of individualized instruction students can be made aware of the need for continued learning and the necessity for constant examination and analysis of matters with which they become concerned. Since it is apparent that "information" as knowledge cannot be considered as unchanging, individualized instructional processes provides the basis for the location and evaluation of new information as it becomes available and the incorporation of this into the working resources with which continued experiences can be met.[5]

[5] See: Fall, Charles R., Individualized Instruction in Teacher Education, Part I, Inter-University Project One, State University of New York at Buffalo, Buffalo, New York, May, 1966.

# Computer Based Resource Unit Instruction

In an attempt to describe the total process that characterized computer-based resource unit instructional endeavor, a step-by-step analysis will be made. This should provide an understanding of the fundamental principles involved as well as the procedures through which materials can be accumulated, processed and made available for the improvement of instruction.

## DEVELOPMENT OF RESOURSE UNITS ETC.

As has been indicated, the basic compilation of materials and procedures of instruction is in the form of a resource unit. This composite accumulation can be developed through any of many patterns of endeavor. It can be compiled through a total staff effort in a subject area. It can be organized through professional organization endeavor and made available to institutions on a local, regional or national basis. It can be provided through actual student participation processes. In fact the variety of patterns through which resource units can be designed is as broad as imagination can afford. The significant point is that it is necessary to start the operation with a comprehensive and exhaustive set of materials. It is from this initial effort that all other endeavors flow.

In previous comments the structure of the resource unit has been eluded to. In essence a resource unit is a reservoir of suggestions and ideas related to an instructional topic which an instructor may use to help in the planning of instructional sequences. It should include at least the following elements:

### 1) Objectives

Suggestions of learning goals or desired outcomes toward which instruction on the topic should or could be directed. Deciding upon ends to be served is the primary function in all teaching for it is upon the basis of such decisions that all instruction is structured. In the resource unit, all possible ends (objectives) are noted, for the wider the range of suggested learning outcomes, the more likely will there be some which will fit particular students and particular learning settings.

### 2) Subject-Matter Elements

In any instructional area there are elements of subject matter (information, knowledge) which will lead to the attainment of the learning goals selected. Unfortunately, in much of the common instructional planning it is assumed that accumulating certain informational elements automatically leads to the learning outcome. Unfortunately, this is seldom the case. Thus, it is imperative that the selection of subject matter elements be in terms of helping the learner progress toward the goals desired.

### 3) Instructional Activities

Uncommon though it may seem from actual practices in most modern institutions, there is a tremendous variety of patterns through which learning can be directed toward selected ends or goals. Unfortunately, most efforts are structured around lecture and/or recitation procedures even though studies have revealed that in many instances these are the least productive means by which significant goals or ends can be served. A well-constructed resource unit will include a variety of suggested instructional patterns, providing the instructor with a reservoir of ideas from which he can select the mode with the greatest apparent potential for meeting the needs of the particular circumstance.

### 4) Instructional Materials and Aids

The bulk of information available on almost any subject is of fantastic magnitude, yet in a great many situations a single text or a required outline is made the core of the informational resources from which learning is to be initiated. Not only is there a massive collection of reference materials available for any instructional topic, but there is also an extremely vast quantity of instructional aids that can be used to enrich instruction and spur the activity toward accepted goals. These can be compiled for the resource unit so that an instructor can select those materials and aids which hold promise for encouraging effective activity on the part of students with whom he is involved.

### 5) Evaluative Processes

The "mid-term" and the "final" are the theme elements of practically all evaluation efforts in much of higher education today. These processes may be quite helpful for certain purposes, but they provide little evidence of progress being made by students toward learning goals which are considered important. Actually about all such procedures reveal is how much information (and this can't be termed knowledge) students have been able to temporarily retain, after which much of it is relegated to a metal scrap heap. The essential purpose of evaluation is to estimate the nature of progress being made toward the goals selected. There are many processes through which this can be done and the resource unit should contain a

large selection of those instruments, devices and processes which have application to the area and which afford the means by which progress toward ends can be estimated.

Not to be neglected is the need for self-evaluative processes. Actually, these may be more important than others upon which major emphasis has been characteristically placed. The real learning value of doing an analysis of progress is to assist the individual to recognize his own progress. This is not the major emphasis of much of the evaluative effort. A resource unit can be of inestimable value to individual instructors, if suggested self-evaluative procedures are noted.

## Programming Into Computer-Retrieval System

Upon the completion of a resource unit it is programmed into a computer retrieval system in order to provide individual instructors with planning guides. This is done by coding all items in the resource unit in the following manner:

a) With the objectives of the resource unit as a base, each item in the unit is judged carefully by an experienced instructor who identifies which objectives are directly related to each item in the resource unit. These decisions are coded. For example, a specific objective will be related to (1) certain items of subject matter, (2) certain introductory, developmental, and continuing activities, (3) certain reference materials or instructional materials, (4) certain classroom techniques, and (5) certain measuring devices.

b) In like manner, professional decisions of experienced instructors will serve as a basis for coding. To this end, a second set of variables have been developed which will enable the electronic equipment to do specific tasks for the teachers. These variables, related to professional knowledge about teaching, are listed below:

Objectives
- Information
- Understanding
- Behavior
- Attitude
- Appreciation
- Critical Thinking

Group Activity
- Large
- Small
- Individual

Evaluation Devices
- Standard Tests
- Paper Pencil Essays
- Paper Pencil Objectives
- Rating Scale
- Check List
- Log Dairy
- Tapes and Records
- Films
- Observations

Suggested Approach
- Introductory Activities
- Developmental Activities
- Culminating Activities
- Extra-Curricular Activities

Instructional Activity
- Problem Solving
- Lecturing
- Data Collection
- Drill Practice
- Oral
- Listening
- Writing
- Observation
- Reading
- Instructor-Led Discussions
- Small Group Discussions
- Lab Work
- Recitation
- Programmed Materials

Materials
- Books
- Printed Material
- Films
- Filmstrips
- Resource People
- Resource Places
- Charts
- Maps
- Blackboard Design
- Opaque Projector Materials
- Overhead Projector Materials
- Sponsored Materials
- Tapes
- Records
- Slides
- Art Materials

c) With the competency objectives of the unit as a base, each item in the resource unit will be judged carefully by an experienced instructor for relationships to individual study activities. These will then be coded so as to insure the production of an independent study guide for each individual that is related to the objectives which have been selected.

Once the decision making process had resulted in specific learning objectives, what can the instructor expect from the information retrieval system? He can get a set of suggestions which have been typed by the electronic equipment which will form a Resource Guide. This guide will provide for the instructor an outline of the subject matter;

large group, small group, and independent study activities; instructional material and resources; and measuring devices - all of these related to the objectives and the professional decisions indicated.

Diagram A represents, schematically, how one set of suggestions in the resource guide will be processed for the teachers after the unit topic has been chosen and the learning outcome variables have been decided on. All data in the machine will be screened for the variable concerned with chosen objectives. Myriad but pertinent items will be suggested in the following classifications: subject matter; instructional materials and resources; introductory, developmental and continuing activities for the total group; measuring devices; and small group and independent study activities.

Diagram B represents, schematically, how an independent study guide will be produced after the individual learning variables have been decided upon.

## What An Instructor Can Be Supplied

In summary, once the instructor has chosen the unit topic, has indicated the specific learning outcomes and has made the professional decisions about what he wishes to develop in this unit, and has provided information about the specific students in his classroom, what can he expect to get from the data processing equipment? He will get two sets of suggestions which have been typed by the electronic equipment. This we have named a Resource Guide. The first set of suggestions will be related to the specific objectives the teacher identified, and the second set will be related to the individual students in his course.

Stated in other terms, the resource guide will provide the instructor after the electronic data processing equipment has done its work, with two printed sections: the first section will outline subject matter, large and small group activities, and measuring devices as these items relate to those objectives which the teacher has chosen. The second part of the resource guide will provide the instructor with suggestions for individual activity and instructional material (for each individual student) related to those specific learning outcomes originally chosen by the instructor.

Again the basic purpose of this entire activity: to save the instructor pre-planning time by providing pertinent suggestions in regard to a specific unit of instruction as that unit of instruction relates to specific learning outcomes which the instructor has chosen and as that unit of instruction relates to the specific abilities, interests, characteristics, and needs of the students in the classroom. This, in turn, will provide for the instructor a resource guide made up of two parts: the first part will contain large and small group activities related to subject matter and objectives: the second part will contain suggestions of individual activities and materials for each student in the class as these materials and activities relate to the specific objectives.

## Use of Resource Guides in Student-Instructor Planning

The involvement of students in the actual course or subject planning process is an essential procedure. Under ordinary circumstances where overburdening responsibilities are placed upon the instructor by the lack of pre-planning assistance and the ever-bludgeoning enrollments with which most are confronted, little can be done to encourage student participation in class planning procedures. However, the computer-based resource unit makes available a wealth of material and a variety of operational suggestions all of which are at the beck and call of the instructor thus relieving him of much of the onerous detail that plagues normal teaching requirements.

Thus, computer-based resource unit instruction affords a means by which student participation can be encouraged. In fact, instructors may wish to involve pupils in the initial planning of learning outcomes for the unit of instruction. Then, after objectives have been cooperatively defined, the resource guide can be obtained. Since this entire process of printing a resource guide takes minutes, such activity can be encouraged. However, should the instructor use the resource guide as a standard for pre-planning before pupil-teacher planning, the following suggestions are given to help in this process.

1) Determine the approximate amount of time (two weeks, five weeks, etc.) that can be devoted to this unit of instruction.

2) Study the possible introductory (suggested approaches), developmental, and culminating activities that might be used and select five or six activities in each category which best meet the needs of the students.

3) Collect the materials needed for these activities and make the necessary contacts.

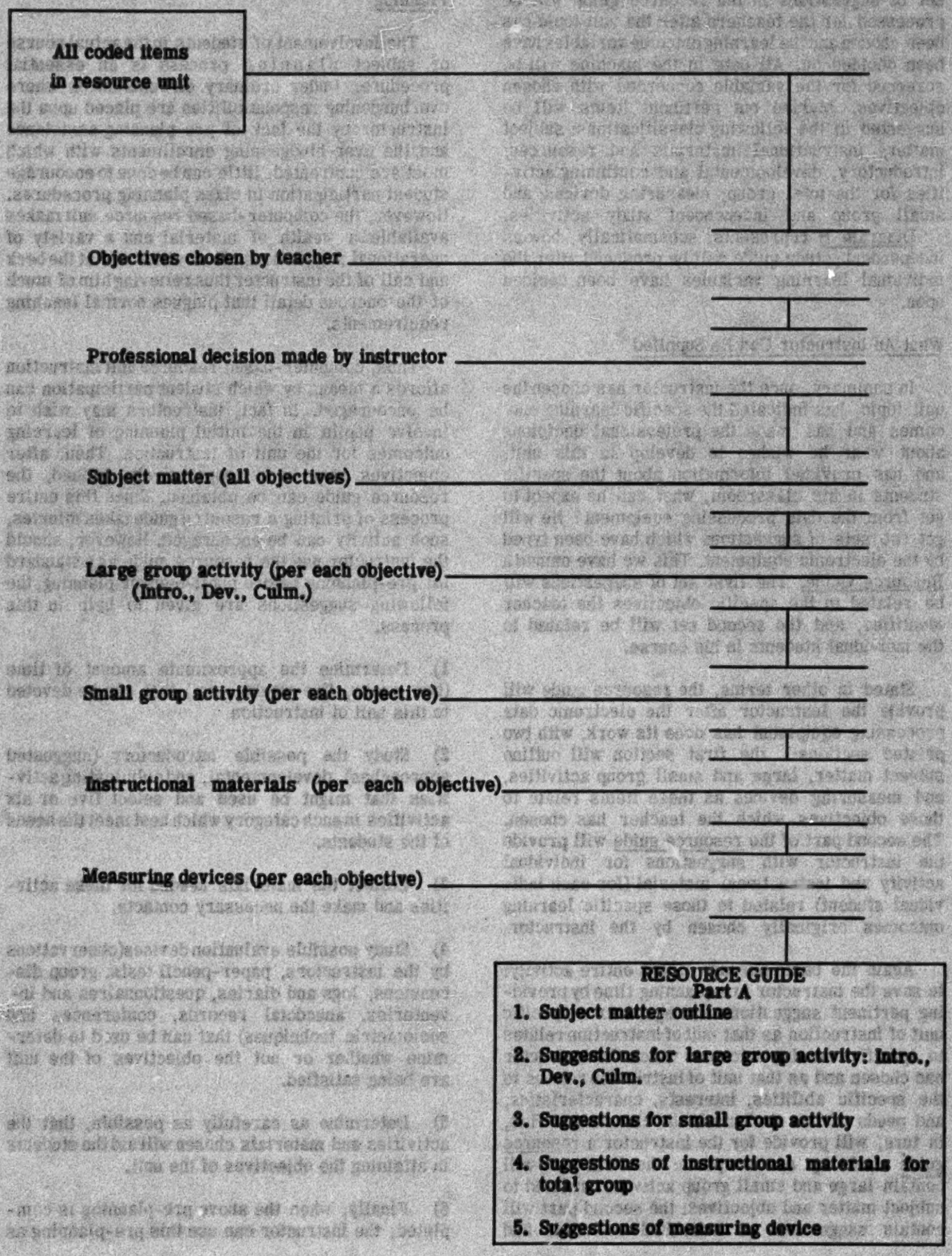
4) Study possible evaluation devices(observations by the instructors, paper-pencil tests, group discussions, logs and diaries, questionnaires and inventories, anecdotal records, conferences and sociometric techniques) that can be used to determine whether or not the objectives of the unit are being satisfied.

5) Determine as carefully as possible, that the activities and materials chosen will aid the students in attaining the objectives of the unit.

6) Finally, when the above pre-planning is completed, the instructor can use this pre-planning as

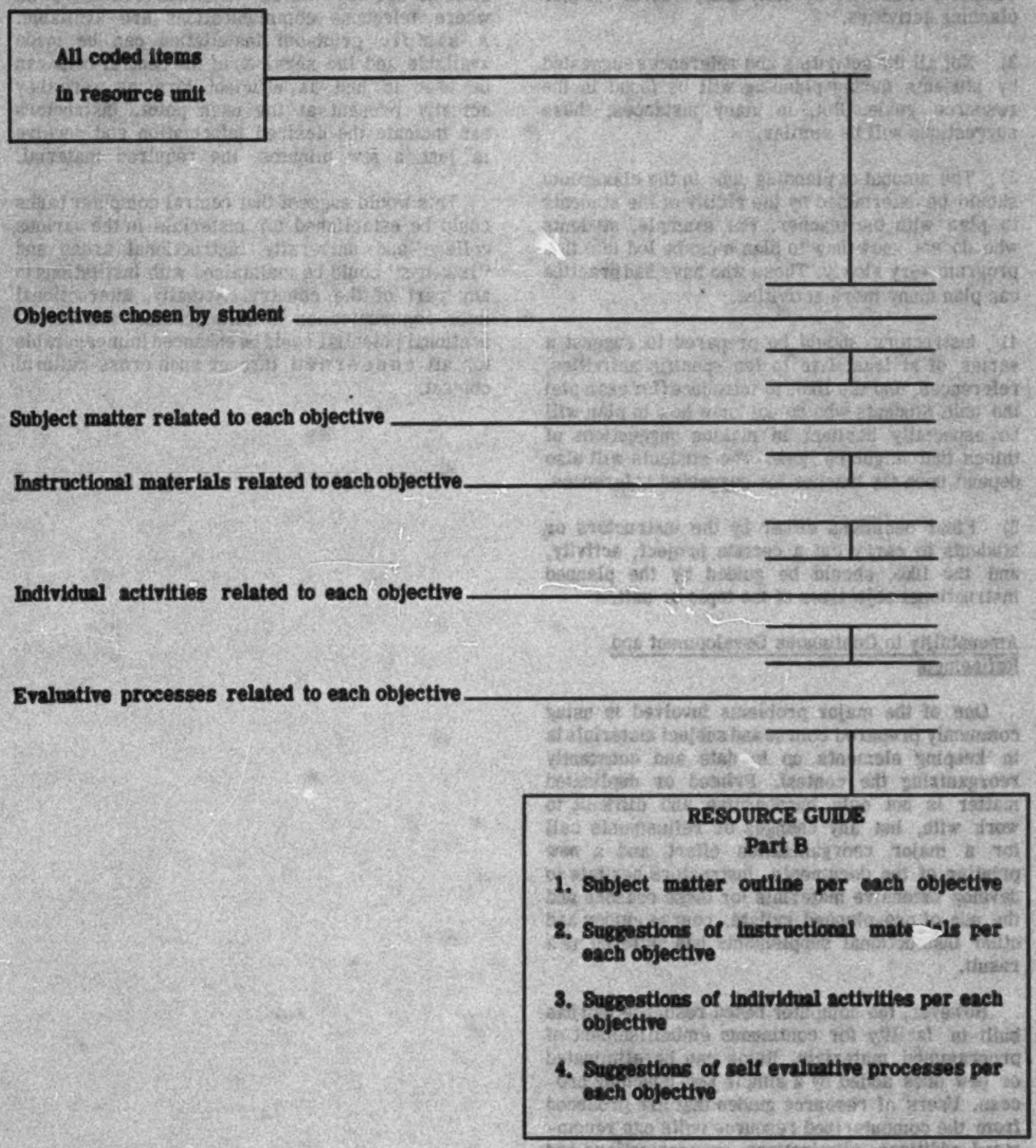
**DIAGRAM A**

**A Screening Process for Identifying Unit Suggestions for Large and Small Group Operation: Part A of Resource Guide**


All coded items in resource unit
Objectives chosen by teacher
Professional decision made by instructor
Subject matter (all objectives)
Large group activity (per each objective) (Intro., Dev., Culm.)
Small group activity (per each objective)
Instructional materials (per each objective)
Measuring devices (per each objective)
RESOURCE GUIDE
Part A
1. Subject matter outline
2. Suggestions for large group activity: Intro., Dev., Culm.
3. Suggestions for small group activity
4. Suggestions of instructional materials for total group
5. Suggestions of measuring device

## DIAGRAM B

**Screening Process for Identifying Unit Suggestions for an Individual Learner: Part B - Resource Guide**


All coded items in resource unit
Objectives chosen by student
Subject matter related to each objective
Instructional materials related to each objective
Individual activities related to each objective
Evaluative processes related to each objective
RESOURCE GUIDE
Part B
1. Subject matter outline per each objective
2. Suggestions of instructional materials per each objective
3. Suggestions of individual activities per each objective
4. Suggestions of self evaluative processes per each objective

a frame of reference to aid his own thinking as he plans with and guides the students.

## Points to Emphasize

1) A thorough understanding of the wealth of resources in the resource guide is necessary to complete instructor security in any student-teacher planning activities.

2) Not all the activities and references suggested by students during planning will be found in the resource guide. But, in many instances, these suggestions will be similar.

3) The amount of planning done in the classroom should be determined by the ability of the students to plan with the teacher. For example, students who do not know how to plan must be led into this program very slowly. Those who have had practice can plan many more activities.

4) Instructors should be prepared to suggest a series of at least five to ten specific activities, references, and the like, to introduce (for example) the unit. Students who do not know how to plan will be especially hesitant in making suggestions of things that might be done. The students will also depend upon the teacher for suggested references.

5) Final decisions either by the instructors or students to carry out a certain project, activity, and the like, should be guided by the planned instructional objectives of the topic or unit.

## Amenability to Continuous Development and Refinement

One of the major problems involved in using commonly prepared course and subject materials is in keeping elements up to date and constantly reorganizing the content. Printed or duplicated matter is not only burdensome and difficult to work with, but any changes or refinements call for a major reorganization effort and a new printing of the documents. Instructors hesitate to develop extensive materials for these reasons and the use of pre-planned syllabi, course guides and other instructional supplements has suffered as a result.

However, the computer based resource unit has built-in facility for continuous embellishment of programmed materials. Items can be eliminated or new ones added by a simple key-punching process. Users of resource guides that are produced from the computerized resource units can recommend additions, eliminations, reorganizations and refinements and these can be handled in a very simple and efficient fashion. As a consequence, a computer-based resource unit that is once programmed for electronic processing can be constantly up-dated and continuously refined with the input from all who make use of its elements.

## Tie-in Possibilities of Central Computer Banks

Another extremely significant feature of the computer-based resource unit instructional concept, is the flexibility inherent in its network possibilities. Once materials are made available in a computer installation bank, it would be possible to develop "tie-in" functions from any point where telephone communications are available. A simple print-out installation can be made available and the services of the central bank can be used in just as efficient form as were they actually present at the user point. Instructors can indicate the desired information and receive in just a few minutes, the required material.

This would suggest that central computer banks could be established for materials in the various college and university instructional areas and "link-ups" could be maintained with institutions in any part of the country. Actually, international inter-communication is quite possible and the educational potential could be enhanced immeasurable for all concerned through such cross-cultural contact.

# Means of Developing Basic Resource Unit Material

A major concern in the development of the computer-based instructional program is the building of basic resource units from which to work. Several approaches can be recommended, though the process will have to be instituted in a particular situation which best suits the needs and the possibilities of the circumstance.

a) Developing Resource Units Through Staff Project Activity.

Traditionally staff groups in any area have accepted the responsibility for preparing instructional support material for use in various courses and subjects. Though the products of these efforts have often been sterile and uncreative, they have been used by faculty as guides to the pattern of instructional efforts that is designed. Unfortunately, most such course guides consist of suggested lecture outlines and recitation formats. These tend to perpetuate an unvaried pattern of teaching and offer little in the way of broadly representative selections of instructional resources.

Resource units could be devised through staff project activity by having faculty members pool their resources and construct a comprehensive outline of materials representing all of the elements in a resource unit. This could then be coded by "expert" teachers in the discipline and programmed for computer use. Instructional guides could then be supplied to all staff members for use in courses or sections as necessary.

b) Bringing Together Experts in an Instructional Field

An institution or a group of institutions could organize a project to bring together a group of experts in a subject-area or discipline to build a resource unit. Here again the effort should be upon bringing to bear the most modern ideas in a field in a way to produce a comprehensive compilation of materials. Again, the elements of the resultant unit could be coded by selection experts and programmed for computer processing.

c) State, Regional or National Associations in Instructional Fields.

It is conceivable that instructional area associations could serve as generating agencies for resource unit development. All such associations have as a primary purpose the improvement of instruction in the specialities encompassed in their field. Providing computer-based resource units could be an unusually effective means of supporting area improvement.

Such associations are extremely well-organized for such purposes. In fact, the very structure of such associations and their typical patterns of operations would be conductive to efforts in this line. Workshops, conferences, general meetings, communication with members of the field--these and the many other characteristics of common association activity are the very patterns of endeavor which could produce valuable resource material.

Perhaps there are numerous other approaches to the problem of building banks of instructional resources. The above may be indicative of how individuals, groups and organizations could approach this vital task. It would only be hoped that the magnitude of the task would not destroy the desire to accomplish it for the end of such effort is the general improvement of the quality of instruction in the field in which the efforts are applied.

# Conclusions

That learning is a process involving more than mere acquisition of facts is generally agreed. Actually it is an extremely complex human endeavor and one that challenges all of the ingenuity and creativity that an instructional staff can muster. It is therefore imperative that all who are involved in college and university endeavor promote the most promising processes and continually explore prospects for making more rich and fruitful the experiences which characterize the instructional scene.

Actually there is some general agreement on the basic elements which typify learning activity. First, the student must be integrally involved in the circumstance which surrounds the learning endeavor. He must be "bound up" in the forces inherent in the situation and see in them a prospect for involving himself in a meaningful fashion. Second, in such a context he must encounter elements which require the projection of goals or ends toward which he would want to strive and toward which he would want to devote his energies. Third, he must have available the assistance of intelligent guidance in the form of instructional direction and peer group cooperation, all of which will serve to bolster efforts to move toward the ends desired. Fourth, this assistance must include help in discovering and obtaining material aids and other resources which will contribute to some movement toward the eventual accomplishment of the tasks involved. Fifth, he must be provided the opportunity and assisted in the process of applying the learning resources to the learning problems at hand. And, finally, he must be provided with the opportunity and the wherewithal to assess his progress toward the learning goals which were being served.

This description of the learning process prescribes for the instructor the ingredients of effective instructional behavior. It is evident that an instructor cannot guide and enhance such processes by using techniques devoted only to the transmission of facts and bodies of information. He must rather develop an approach which contributes, at every stage, to the manner in which learning takes place. This suggests that effective instructional processes need to be characterized by the following emphases:

1) Involvement of the Learner.

Instructors must provide situations in which learning elements embrace the student. There must be a concerted effort to assure that students are involved in experiences which encompass them with exciting possibilities for exploitation. It may be contended that many teaching areas cannot be manipulated in this fashion and that much has to be learned of mundane, routine, and distastful nature before the intriguing aspects are encountered. Though it could be said that some elements of learning are of this sort, it must also be recognized that immaginative, creative and unusual prospects are possible in every speciality. If this general principle were to be accepted, it is likely that instructors would strive for greater student interest and means of achieving more wholesale and wholehearted student involvement.

2) Meaningful learning goals (objectives).

All instruction must be based upon ends which are appropriate and which inspire efforts on the part of learners in striving to reach them. Goals to be of value in stimulating learning cannot be isolated from the lifestream of the student. Instead, goals must become the vital ends toward which he is willing to marshall his energies and direct his efforts. Thus, this characteristic of instructional endeavor requires a clear vision of prospective ends or goals on the part of the instructor and the student.

3) Movement toward goals selected.

Every learning activity organized by an instructor must be selected in terms of its potential for movement toward the goals decided upon. In too many instances the nature and sequence of instructional procedures are determined by how much "ground" can be covered or how much information can be transmitted. Obsession with covering "ground" or transmitting information is obviously useless in promoting learning unless such activity is characterized by student desire to obtain facts and information in progressing toward chosen objectives or goals. When this is the case, acquiring facts or obtaining bodies of information serves to enhance movement in the directions required. However, it is important to note that fact and information acquisition is not the only means of proceeding toward the attainment of learning objectives. Many and diverse kinds of instructional experiences can be encouraged in ways that contribute to meaningful progress toward ends desired. The effective instructor must search for those instructional experiences of promise and be able to conduct with facility those which are selected for the particular circumstance.

4) Assistance in discovering and obtaining appropriate learning resources.

The instructional situation of high learning potential for the student must include abundant

assistance in discovering and obtaining appropriate reference materials, learning aids and other accounterments having prospects for promoting efforts of a constructive nature. The single text, the sterile syllabus, the laboratory manual are all outmoded as major emphases for instruction. With the "explosion" in knowledge areas, the results of such restrictive treatment can be tragic to individuals and calamitious to modern society. The issue can no longer be whether or not widespread resources are available, but rather, whether or not we can supply the instructional genius and the supporting processes to ensure availability to students.

5) Opportunity for students to apply learning resources to problems encountered in progress toward goals.

Having available inexhaustable supplies of instructional resources does not in itself guarantee that these will be of value to learning. There must be ample opportunity to make use of available instructional resources in a fashion that contributed meaningfully to an individual's learning endeavor. Such opportunity can be afforded only through instructional leadership that is built upon an understanding that the student must be able to use the learning resources in his attempts to achieve the learning objectives that are agreed upon. The competent college or university instructor must ensure the availability of instructional resources, but more importantly must be able to provide the setting which will encourage the application of such resources in an on-going movement toward accepted learning goals.

6) Evaluation of efforts in terms of progress made.

There is a tremendous bulk of material available in testing and measuring of student information acquisition. In practically all of this, the emphasis is upon measuring the quantity (and some suggest, quality) of transmitted information and supposedly acquired knowledge. However, there is considerable evidence that repitition of facts and information selected from a morass that has been the essence of an instructional sequence is not necessarily evidence that learning has really taken place. Yet, the major emphasis in evaluation of student learning has been of the sort that tests the amount of factual information possessed by the learner.

If learning is a process of movement toward varied selected objectives or goals, then other processes must be evolved by the instructor and the learners to measure progress being made toward all of the goals which have been instituted. Such processes would indeed include attempts to determine the magnitude and quality of factual information acquired, but more importantly they would need to illuminate the manner in which reconstruction or reorganization was taking place in the learner and the effect that this was having upon the progress being made toward ends-in-view. The instructors role is not, therefore, a simple matter of selecting and administering tests; it is rather that of providing a continuous program of evaluation which illuminates at all times the manner in which learners are progressing toward the ends desired.

## Contributions of Computer-Based Resource Units to Effective Instruction

It is evident that instructional processes designed with a view to providing effective learning opportunities requires exceptional talent and exhaustive effort on the part of a college or university instructor. As an organizer and director of learning activities, he must be capable of performing a multitude of functions, he must possess a reservoir of knowledge of unusual proportion, and he must have available almost unlimited amounts of time to engage in pre-planning, in-course planning and extensive post-planning. In addition, a conscientious instructor must be a veritable human dynamo in actual instructional circumstances. He must be aware of each individual's needs, concerns, and goals. He must organize instructional circumstances that are constantly in tune with these factors. Such demands go beyond human capacity if they are all to be fulfilled by the instructor himself with a view to affording an instructional circumstance that meets the demands of good learning opportunity.

Electronic processing of resource materials offers hope however. Rather than the instructor being expected to incorporate all of the features of an ideal learning environment into his work through personal endeavor, the computer-based resource unit process can supply unusual assistance in many aspects of the endeavor. It can provide, in an extremely efficient fashion, a guide for instruction that includes suggested materials and patterns of endeavor upon which an instructor can direct learning experiences toward selected goals. By making available the potential of electronic processing, many of the time and effort consuming activities of the instructor can be eliminated.

Not only does computer-based resource unit instruction preserve the learning qualities of situations as dictated by accepted principle of learning, it is a means of providing an instructor with a wealth of assistance and support that is of tremendous variety and fantastic magnitude.